PROBLEMS.

22. Proposed by G. B. M. ZERR, A. M., Principal of High School, Staunton, Virginia.

Decompose into the sum of two squares the product $5\times13\times61$.

23. Proposed by J. M. COLAW, A. M., Principal of High School, Monterey, Virginia.

Find three positive integral numbers such that the *product* of the first and the sum of the others is a square and the *sum* of their cubes is a square.

24. Proposed by F. P. MATZ, M. Sc., Ph. D., Professor of Mathematics and Astronomy in New Windsor College, New Windsor, Maryland.

Solve *generally*: The sum of the cubes of n consecutive numbers is a square. Determine the numbers, when $n=2$, $n=3$, $n=4$, and $n=5$.

AVERAGE AND PROBABILITY.

Conducted by B. F. FINKEL, Kidder, Mo. All contributions to this department should be sent to him.

SOLUTIONS TO PROBLEMS.

12. Proposed by G. B. M. ZERR, A. M., Principal of High School, Staunton, Virginia.

A large plane area is ruled by two sets of parallel equidistant straight lines, the one set perpendicular to the other. The distance between any two lines of the first set is a; the distance between any two lines of the second set is b. If a regular polygon of $2n$ sides be thrown at random upon this area, find the chance that it will fall across a line, the diameter of the circum-circle of the polygon being less than a or b.

I. Solution by the PROPOSER.

Let $2r$ be the length of the diagonal of the polygon, θ its inclination to the length a.

Then if the centre of the polygon falls anywhere on the area $\{ab-(a-2r\cos\theta)(b-2r\cos\theta)\}$ it will fall across a line.

The limits of θ are 0 and $\dfrac{\pi}{2n}$.

$$\therefore \text{ Chance}=p=\frac{\int_0^{\frac{\pi}{2n}}\{ab-(a-2r\cos\theta)(b-2r\cos\theta)\}d\theta}{\int_0^{\frac{\pi}{2n}}ab\,d\theta}.$$

$$p=\frac{2r(a+b)\sin\dfrac{\pi}{2n}-\dfrac{\pi r^2}{2}-r^2\sin\dfrac{\pi}{n}}{\dfrac{\pi ab}{2n}}$$

$$=\frac{4r(a+b)n\sin\frac{\pi}{2n}-r^2(2\pi+2n\sin\frac{\pi}{n}}{\pi ab}.$$

If $n=2$, $p=\dfrac{4r(a+b)\sqrt{2}-r^2(2\pi+4)}{\pi ab}$.

Let $l=4rn\sin\frac{\pi}{2n}$ be the perimeter of the polygon.

Then $p=\dfrac{(a+b)l-2\pi r^2-rl\cos\frac{\pi}{2n}}{\pi ab}$.

Let b be infinite.

Then $p=\dfrac{l}{\pi a}=\dfrac{l}{l'}$, where l' is the perimeter of the circle having a for its diameter.

Excellent solutions were received from *Professors Matz and Draughon*. Their solutions may appear in January Number.

PROBLEMS.

22. Proposed by ALTON L. SMITH, Instructor in Drawing, Polytechnic Institute, Worcester, Mass.

In a series of counts of the votes on a legislative act relative to the city of Worcester, the followidg results were obtained:

	YES.	NO.
1st count	5566	5511
2nd "	5519	5558
3d "	5546	5517
4th "	5512	5551
5th "	5512	5541

What is the probability that the last count (5th) is correct?

23. Proposed by F. P. MATZ, M. Sc., Ph. D., Professor of Mathematics and Astronomy in New Windsor College, New Windsor, Maryland.

Find the average area of all the triangles that can be drawn *perpendicular-sided* to a given plane scalene triangle.

EDITORIALS.

An exhaustive solution to problem 33, Arithmetic Department, was received from A. H. Bell, but too late for credit in the proper place.

D. G. Durrance should have been credited with solving problem 32, Arithmetic Department.

We can furnish a limited number of complete sets of Vol. I, for $2.00.